

Claims

- [c1] A vehicle crash safety system for an automotive vehicle comprising:
- a pre-crash sensing system generating a pre-crash signal;
 - a vehicle dynamics detector generating a vehicle dynamics signal;
 - a pre-crash countermeasure system;
 - a pre-crash controller controlling the pre-crash countermeasure system in response to the said pre-crash signal and said vehicle dynamics signal, said pre-crash controller generating a pre-crash controller signal;
 - an early crash sensing system generating an early crash signal;
 - an early crash countermeasure system; and
 - a coordinated safety system controller coupled to the pre-crash controller, the early crash sensing system, and the early crash countermeasure system, said coordinated safety system controller controls the early crash countermeasure in response to the early crash signal and said pre-crash controller signal.
- [c2] A system as recited in claim 1 wherein the pre-crash

sensing system comprises a vision system.

- [c3] A system as recited in claim 2 wherein the vision system comprises a stereo pair of cameras.
- [c4] A system as recited in claim 1 wherein the pre-crash sensing system comprises a receiver.
- [c5] A system as recited in claim 1 wherein the pre-crash sensing system comprises a radar or lidar.
- [c6] A system as recited in claim 1 wherein the pre-crash sensing system comprises a transponder.
- [c7] A system as recited in claim 1 wherein the vehicle dynamics detector comprises a speed sensor.
- [c8] A system as recited in claim 1 wherein the vehicle dynamics detector comprises a yaw sensor.
- [c9] A system as recited in claim 1 wherein the vehicle dynamics detector comprises a steering wheel angle sensor.
- [c10] A system as recited in claim 1 wherein said pre-crash controller activates said pre-crash countermeasure in response to target object distance, relative velocity and target object size signals.
- [c11] A system as recited in claim 1 wherein the pre-crash

countermeasure system comprises at least one of an active safety system, a motorized seatbelt pretensioner, a bumper airbag system, a suspension height adjustment system, a structural stiffness modifier system, or a collision warning system.

- [c12] A system as recited in claim 1 wherein said early crash countermeasure system comprises at least one of a driver airbag system, a passenger airbag system, a seatbelt system, a deployable steering system, a deployable lower extremity protection system, a deployable knee bolster system, or an anti-submarining system.
- [c13] A system as recited in claim 1 wherein said early crash sensing system comprises at least one crash sensor.
- [c14] A system as sited in claim 1 wherein said early crash sensor system comprises a crash sensor, a seat position and seat inclination sensor, a seat weight sensor, a seat belt usage sensor, an occupant position and classification sensor and an airbag control switch.
- [c15] A method for operating a vehicle crash safety system for an automotive vehicle comprising:
 - generating a pre-crash signal from a pre-crash sensing system;
 - generating a vehicle dynamics signal from a vehicle dy-

namics detector;
controlling a pre-crash countermeasure system in response to the pre-crash signal and the vehicle dynamics signal;
generating an early crash signal from an early crash sensing input system; and
controlling an early crash countermeasure system in response to the early crash signal and the pre-crash signal.

- [c16] A method as recited in claim 15 further comprising co-ordinating a deployment of the pre-crash countermeasure system and the early crash countermeasure system.
- [c17] A method as recited in claim 15 wherein said early crash countermeasure system comprises at least one of a driver airbag system, a passenger airbag system, a seat-belt system, a deployable steering system, a deployable lower extremity protection system, a deployable knee bolster system, or an anti-submarining system.
- [c18] A method as recited in claim 15 wherein said early crash sensing system comprises at least one crash sensor.
- [c19] A method as recited in claim 15 wherein the early crash sensor system comprises a crash sensor, a seat position and seat inclination sensor, a seat weight sensor, a seat

belt usage sensor, an occupant position and classification sensor, and an airbag control switch.

- [c20] A vehicle crash safety system for an automotive vehicle comprising:
 - a pre-crash sensing system generating a pre-crash signal;
 - a pre-crash countermeasure system;
 - a pre-crash controller controlling the pre-crash countermeasure system in response to the said pre-crash signal, said pre-crash controller generating a pre-crash controller signal;
 - an early crash sensing system generating an early crash signal;
 - an early crash countermeasure system; and
 - a coordinated safety system controller coupled to the pre-crash controller, the early crash sensing system, and the early crash countermeasure system, said coordinated safety system controller controls the early crash countermeasure in response to the early crash signal and said pre-crash controller signal.